September 24, 2001

MEMORANDUM

TO: Jim Johnston, Administrator
Idaho Falls Regional Office

FROM: Eric Antrim, EIT EQA
State Office of Technical Services

THROUGH: Shawnee Chen, PE, Staff Engineer SYC
State Office of Technical Services

SUBJECT: TIER II TECHNICAL ANALYSIS
T2-010544, Challis Redi-Mix, Challis
(Concrete Batch Plant Tier II Operating Permit Number 037-00008)

PURPOSE

The purpose of this memorandum is to satisfy the requirements of IDAPA 58.01.01.400 (*Rules for the Control of Air Pollution in Idaho*) for issuing Tier II Operating Permits.

PROJECT DESCRIPTION

This facility was installed without a permit to construct. Because the concrete batch plant gets its sand and gravel from a nearby gravel pit and because 90% of the sand and gravel produced by the gravel pit is used for this concrete batch plant, the two were considered to be one facility. Both locations are under common control and ownership. It was determined that a facility-wide tier II operating permit would be the most appropriate permitting action because it would allow the inclusion of sources at the gravel pit. The standard permit to construct for concrete batch plants was heavily relied upon even though this batch plant is not portable and is powered by the local utility. Therefore, the standard permit to construct had many requirements and provisions that were not included in the current Tier II because those provisions did not apply to this situation and complicated the permit needlessly. This permit was issued under the authority of IDAPA 58.01.01.401.03.b (i.e., requirements necessary to ensure compliance).

FACILITY DESCRIPTION

Challis Redi-Mix purchased a concrete batch plant (CBP) and a sand and gravel pit in 1989. The facility has been located and operating in the same location just outside of Challis, Idaho, since 1978. The facility rarely approaches design capacity, and has no full-time employees. According to a phone conversation with the owner, the facility does not plan to relocate.

The sand and gravel pit is about one quarter mile from the CBP. There is a two-deck wash plant with a 125-kilowatt (kW) generator permanently located at the pit. Also in the pit is a portable screen powered by a 10 horsepower (hp) generator that is sometimes leased and relocated. For about a week each year, a crusher is brought to the gravel pit to crush enough gravel for the rest of the year. About 90 percent of the gravel produced in the pit is used in the CBP. The rest is sold directly to the public.

The CBP has a maximum production capacity of 50 cubic yards of concrete per hour. It is powered by the local utility. There are no elevated storage bins for sand and gravel. For each batch of concrete, the sand and gravel weigh bins are loaded with a front-end loader. There is no control equipment on the cement silo stack; a rain cap protects the cement from moisture.

SUMMARY OF EVENTS

On May 21, 2001, the Idaho Department of Environmental Quality (DEQ) received a standard permit to construct application form for a concrete batch plant from Challis Redi-Mix in Challis, Idaho. On June 14, 2001, DEQ determined the application to be incomplete. On June 21, 2001, DEQ received additional information. On July 3, 2001, the application was determined to be complete. On August 9, 2001, a proposed permit and associated documentation was made available for public comment. The public did comment on the permit. On September 10, 2001, the public comment period ended.

DISCUSSION

1. Process Description

Sand and gravel are produced by the facility in a nearby gravel pit. The material is transported to the CBP location and stockpiled. Cement is delivered by truck and pneumatically transferred to its storage silo. As air is displaced in the silo, cement dust is emitted from the silo's stack. There is no control device to limit this emission. Power to run the concrete batch plant is provided by the local utility. At the gravel pit, a 125 kW diesel-fired generator powers a wash plant. A ten-hp diesel-fired generator powers a screen.

In addition, a generator is used to power a crusher that locates and operates in the pit for about a week every year. Gayle Lynn of Blackfoot, Idaho, owns the crusher that has been used in the past. The crusher produces enough aggregate for the coming season. According to the method that is found in Chapter 11.12 of the Compilation of Air Pollution Emission Factors (AP-42), this should be approximately 3,000 cubic yards of gravel in a busy year for this facility. A busy year according to the actual production data provided with the application would be 6,000 cubic yards of concrete production.

The production process begins when sand and gravel are fed into the aggregate weigh hopper by a front-end loader. When a pre-determined amount of each is weighed, the sand and gravel is drop-fed onto an inclined conveyor that transfers the mixture into a cement truck. A pre-determined amount of cement is also weighed and drop-fed through a rubber chute into the cement truck. The rubber chute directs the cement and provides a measure of dust control. Water is then added, and the components are mixed in the truck on the way to the job site.

2. Area Classification

The concrete batching facility is located in Custer County, which is unclassifiable for all National Ambient Air Quality Standards (NAAQS).

3. Emission Estimates

AP-42 chapters 11.12 and 3.3 were used to estimate emissions from this facility. These chapters and emission estimates are contained in Appendix A. These emission estimates were used to determine the source's natural minor facility classification (i.e., potential to emit of less than 100 tons per year), ambient impact, and compliance with the applicable grain loading standard.

The ambient impact analysis required an emission estimate for each non-fugitive emission in pounds per hour. These estimates were then used in the modeling analysis. Fugitive dust emissions must be reasonably controlled at all times. In order to ensure the air quality is not degraded beyond the facility boundary, the permit requires that no fugitive emissions be seen crossing the facility boundary. The emissions from fugitive sources were assumed to have no ambient impact.

For purely emission inventory and informational purposes, an estimate of actual facility-wide emissions was made. Actual emissions were based on an annual production of 6,000 yards of concrete. This production has only been attained once in the last seven years according to the facility's application. Fugitive emissions were included to estimate facility-wide emissions. Fugitive emissions are the dominant type of emissions from these sources. The actual emissions would be expected to be less than 1 ton per year of particulate matter. PM_{10} emissions would be even less. This emission estimate is in Appendix A, on engineering paper, with the heading of "Actual Emissions".

Grain loading was addressed for the cement storage silo by estimating the pounds of particulate matter emission and comparing that to the throughput. It was found to comply with IDAPA 58.01.01.710.08.c.iii without controls. As noted in a September 22, 2000, memorandum from Mike Simon, Air Program Office, concerning fuel-burning equipment, the particulate standard may not be reasonable for diesel-fired generators:

> DEQ staff determined that the particulate matter standard for fuel-burning equipment may not be practically achievable in some cases for diesel-fired internal combustion units. In light of this, DEQ will conduct a technical analysis on generator units and consider any appropriate rulemaking regarding particulate matter standards. In the interim, DEQ permitting staff should exercise discretion when considering compliance demonstration requirements for generator sets in the permitting process.

In light of this guidance, the fuel-burning equipment particulate matter standard was not included in the permit.

The opacity from the cement storage silo is not allowed to exceed 20% opacity in accordance with IDAPA 58.01.01.625. Photographs were received from the public, which appear to show the silo emissions having opacity in excess of 20%. It is also realized that the majority of cement silos do use a filter to control emissions. Further, it is the judgement of DEQ engineers that it would be unlikely that the silo could be filled without emissions exceeding 20% opacity. Therefore, it was deemed reasonable for the Department to require the installation of an air pollution control device on the cement storage silo to assure compliance with the opacity standard. IDAPA 58.01.01.405.01 allows the Department to impose reasonable conditions.

Portland Cement is a toxic air pollutant in accordance with IDAPA 58.01.01.585. Also, diesel generators emit organic toxic air pollutants listed in IDAPA 58.01.01.585 and 586. These emission estimates are in Appendix A. The facility was found to emit toxic air pollutants with resulting ambient concentrations less than the acceptable ambient concentrations in 58.01.01.585 and 586.

4. <u>Modeling</u>

It is assumed if no emissions visibly cross the boundary, the ambient air quality is protected from the impact of fugitive emissions. DEQ has been historically satisfied with this approach. The non-fugitive emission sources at the CBP are the cement storage silo and two generators in the gravel pit. The impact of the generators was combined with that of the cement storage silo. The modeling follows the emission estimates in Appendix A.

The 125 kW and 10 hp generators were modeled, and compliance with the NAAQS was demonstrated when the generators were only allowed to operate for 4,500 hours per year. The generator emissions were added and conservatively assumed to emit simultaneously from the 125 kW generator's stack. The yearly hours of operation limit is necessary to protect the annual standard for NO_x.

To estimate the ambient impact of the cement storage silo, the emission factor in AP-42 had to be revised to be in terms of pounds of particulate emission per pound of cement throughput. The factor provided used pounds of concrete production. In the footnotes, the assumed proportions of concrete were shown, and were used to change the emission factor. Also, a very low velocity was used to approximate the effect of a rain cap on the stack.

The silo was allowed 84,000 pounds of cement delivery per day. This is the maximum allowable production rate to protect the NAAQS without imposing daily limits on the generators. This daily limit was also important in establishing that toxic Portland cement emissions did non exceed acceptable ambient concentrations.

5. Facility Classification

This facility is not a major facility as defined in IDAPA 58.01.01.006.55 and IDAPA 58.01.01.008.10. Concrete batch plants are not designated facilities as defined in IDAPA 58.01.01.006.27. Concrete batch plants are not subject to federal New Source Performance Standards or National Emission Standards for Hazardous Air Pollutants. The Standard Industrial Classification code for concrete batch plants is 3273. The Aerometric Information Retrieval System (AIRS) facility classification for this facility is "B" because the uncontrolled potential to emit is less than 100 tons per year.

6. Regulatory Review

This OP is subject to the following permitting requirements:

a.	IDAPA 58.01.01.401	Tier II Operating Permit
b.	IDAPA 58.01.01.403	Permit Requirements for Tier II Sources
c.	IDAPA 58.01.01.404.01(c)	Opportunity for Public Comment
d.	IDAPA 58.01.01.404.04	Authority to Revise or Renew Operating Permits
e.	IDAPA 58.01.01.406	Obligation to Comply
f.	IDAPA 58.01.01.577	Ambient Air Quality Standards
g.	IDAPA 58.01.01.625	Visible Emission Limitation
h.	IDAPA 58.01.01.650	General Rules for the Control of Fugitive Dust
i.	IDAPA 58.01.01.677	Fuel Burning Equipment Grain Loading
j.	IDAPA 58.01.01.710.08.c.iii	Process Equipment Grain Loading

7. AIRS Information

Since this facility is considered a new facility for AIRS purposes, an update to the AIRS database is required. The information necessary to update the database is included as Appendix B of this technical analysis.

AIRS/AFS FACILITY-WIDE CLASSIFICATION DATA ENTRY FORM

Air Program Description	SIP	PSD	NESHAP	NSPS	MACT	TITLE V	AREA CLASSIFICATION A - Attainment U - Unclassifiable N - Nonattainment
SO_2	B						U
NOx	B						U
CO	B						U
PM_{10}	B						U
PT (Particulate)	B						U
VOC	B						U
THAP (Total HAPs)	B						U
Other (specify below:)							
(Add additional lines if necessary.)							
VE/FE/FD *	ND	ND	ND	ND	ND	ND	

* VE/FE/FD (VISIBLE EMISSIONS, FUGITIVE EMISSIONS, AND FUGITIVE DUST) ARE ENTERED FOR COMPLIANCE PURPOSES ONLY AND DO NOT REQUIRE EVALUATION BY THE PERMIT ENGINEER.

AIRS/AFS CLASSIFICATION CODES:

A = Actual or potential emissions of a pollutant are above the applicable major source threshold. For NESHAP only, class "A" is applied to each pollutant which is below the 10 ton-per-year (T/yr) threshold, but which contributes to a plant total in excess of 25 T/yr of all NESHAP pollutants.
SM = Potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable regulations or limitations.
B = Actual and potential emissions below all applicable major source thresholds.
C = Class is unknown.
ND = Major source thresholds are not defined (e.g., radionuclides).

FEES

The facility is not a major facility as defined in IDAPA 58.01.01.008.10. Therefore, registration and registration fees in accordance with IDAPA 58.01.01.526 are not applicable. Because this permit is required by the Department and not requested by the facility, fees in accordance with IDAPA 58.01.01.470 were determined to be not applicable.

RECOMMENDATION

Based on review of application materials and all applicable state and federal rules and regulations, staff recommends that Challis Redi-Mix be issued a Tier II Operating Permit for a portable concrete batching facility.

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Appendix A

Emission Estimates

Modeling

Grain Loading

Fuel-Burning used MS memo & permission, see tech memo under emission estimates

Process -

"exit flowrate of my cement silo is less than 10,000 cubic feet per minute"

- Mike Rukavina fax 7/30/01

∴ 58.01.01.710.08.c.iii applies

gr loading must be < 0.5 #/ton

$$\frac{0.00014 \text{ lb PM}}{\text{lb cement}} \cdot \frac{2000\#}{\text{ton}} = 0.28 \ \#/\text{ton}$$

see "actual silo emissions" for SCREEN3 modeling for explanation

0.28 < 0.5 ∴ OK

Fugitives don't count

silo 5.88 #/hr
gen.s 0.4 #/hr

$$(5.88 + 0.4)\ \#/\text{hr} \left| \frac{\cancel{200}\ \text{ton}}{2000\ \#} \right| \frac{8760\ \text{hr}}{\text{yr}}$$

$\Rightarrow$ 27.5 tpy

Note: the silo only emits while it is filled, this number is unrealistically conservative because it assumes continuous emission

Also, because fugitives are not included, this number does not reflect actual facility emissions. Actual emissions may be greater than PTE in this case.

PTE - potential to emit

Using 6,000 cy/yr (high actual)

Total process incl. traffic 0.22#/cy

Storage piles 3.5 #/acre·day

Gravel pit 30 acres (negligible)
Generators (negligible)

Say 0.25 acre storage pile
(guess)

TPY:

$$\left[\frac{0.22\,\#}{\cancel{cy}} \cdot \frac{6\,000\,\cancel{cy}}{yr} + \frac{3.5\,\#}{\cancel{acre}\cdot\cancel{day}} \cdot 0.25\,\cancel{acre} \cdot \frac{365\,\cancel{day}}{yr}\right] * \frac{ton}{2000\,\#} = \underline{\underline{0.82\ tpy}}$$

This represents particulate matter, PM_{10} would be much less.

All other pollutants are negligible.

This number is realistic and higher than would be actually expected.

3.3 Gasoline And Diesel Industrial Engines

3.3.1 General

The engine category addressed by this section covers a wide variety of industrial applications of both gasoline and diesel internal combustion (IC) engines such as aerial lifts, fork lifts, mobile refrigeration units, generators, pumps, industrial sweepers/scrubbers, material handling equipment (such as conveyors), and portable well-drilling equipment. The three primary fuels for reciprocating IC engines are gasoline, diesel fuel oil (No.2), and natural gas. Gasoline is used primarily for mobile and portable engines. Diesel fuel oil is the most versatile fuel and is used in IC engines of all sizes. The rated power of these engines covers a rather substantial range, up to 250 horsepower (hp) for gasoline engines and up to 600 hp for diesel engines. (Diesel engines greater than 600 hp are covered in Section 3.4, "Large Stationary Diesel And All Stationary Dual-fuel Engines".) Understandably, substantial differences in engine duty cycles exist. It was necessary, therefore, to make reasonable assumptions concerning usage in order to formulate some of the emission factors.

3.3.2 Process Description

All reciprocating IC engines operate by the same basic process. A combustible mixture is first compressed in a small volume between the head of a piston and its surrounding cylinder. The mixture is then ignited, and the resulting high-pressure products of combustion push the piston through the cylinder. This movement is converted from linear to rotary motion by a crankshaft. The piston returns, pushing out exhaust gases, and the cycle is repeated.

There are 2 methods used for stationary reciprocating IC engines: compression ignition (CI) and spark ignition (SI). This section deals with both types of reciprocating IC engines. All diesel-fueled engines are compression ignited, and all gasoline-fueled engines are spark ignited.

In CI engines, combustion air is first compression heated in the cylinder, and diesel fuel oil is then injected into the hot air. Ignition is spontaneous because the air temperature is above the autoignition temperature of the fuel. SI engines initiate combustion by the spark of an electrical discharge. Usually the fuel is mixed with the air in a carburetor (for gasoline) or at the intake valve (for natural gas), but occasionally the fuel is injected into the compressed air in the cylinder.

CI engines usually operate at a higher compression ratio (ratio of cylinder volume when the piston is at the bottom of its stroke to the volume when it is at the top) than SI engines because fuel is not present during compression; hence there is no danger of premature autoignition. Since engine thermal efficiency rises with increasing pressure ratio (and pressure ratio varies directly with compression ratio), CI engines are more efficient than SI engines. This increased efficiency is gained at the expense of poorer response to load changes and a heavier structure to withstand the higher pressures.[1]

3.3.3 Emissions

Most of the pollutants from IC engines are emitted through the exhaust. However, some total organic compounds (TOC) escape from the crankcase as a result of blowby (gases that are vented from the oil pan after they have escaped from the cylinder past the piston rings) and from the fuel tank and carburetor because of evaporation. Nearly all of the TOCs from diesel CI engines enter the atmosphere from the exhaust. Evaporative losses are insignificant in diesel engines due to the low volatility of diesel fuels.

The primary pollutants from internal combustion engines are oxides of nitrogen (NO_x), total organic compounds (TOC), carbon monoxide (CO), and particulates, which include both visible (smoke) and nonvisible emissions. Nitrogen oxide formation is directly related to high pressures and temperatures during the combustion process and to the nitrogen content, if any, of the fuel. The other pollutants, HC, CO, and smoke, are primarily the result of incomplete combustion. Ash and metallic additives in the fuel also contribute to the particulate content of the exhaust. Sulfur oxides (SO_x) also appear in the exhaust from IC engines. The sulfur compounds, mainly sulfur dioxide (SO_2), are directly related to the sulfur content of the fuel.[2]

3.3.3.1 Nitrogen Oxides -

Nitrogen oxide formation occurs by two fundamentally different mechanisms. The predominant mechanism with internal combustion engines is thermal NO_x which arises from the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most thermal NO_x is formed in the high-temperature region of the flame from dissociated molecular nitrogen in the combustion air. Some NO_x, called prompt NO_x, is formed in the early part of the flame from reaction of nitrogen intermediary species, and HC radicals in the flame. The second mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Gasoline, and most distillate oils have no chemically-bound fuel N_2 and essentially all NO_x formed is thermal NO_x.

3.3.3.2 Total Organic Compounds -

The pollutants commonly classified as hydrocarbons are composed of a wide variety of organic compounds and are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned during the combustion process. Most unburned hydrocarbon emissions result from fuel droplets that were transported or injected into the quench layer during combustion. This is the region immediately adjacent to the combustion chamber surfaces, where heat transfer outward through the cylinder walls causes the mixture temperatures to be too low to support combustion.

Partially burned hydrocarbons can occur because of poor air and fuel homogeneity due to incomplete mixing, before or during combustion; incorrect air/fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system; excessively large fuel droplets (diesel engines); and low cylinder temperature due to excessive cooling (quenching) through the walls or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.[2]

3.3.3.3 Carbon Monoxide -

Carbon monoxide is a colorless, odorless, relatively inert gas formed as an intermediate combustion product that appears in the exhaust when the reaction of CO to CO_2 cannot proceed to completion. This situation occurs if there is a lack of available oxygen near the hydrocarbon (fuel) molecule during combustion, if the gas temperature is too low, or if the residence time in the cylinder is too short. The oxidation rate of CO is limited by reaction kinetics and, as a consequence, can be accelerated only to a certain extent by improvements in air and fuel mixing during the combustion process.[2-3]

3.3.3.4 Smoke and Particulate Matter -

White, blue, and black smoke may be emitted from IC engines. Liquid particulates appear as white smoke in the exhaust during an engine cold start, idling, or low load operation. These are formed in the quench layer adjacent to the cylinder walls, where the temperature is not high enough to ignite the fuel. Blue smoke is emitted when lubricating oil leaks, often past worn piston rings, into the combustion chamber and is partially burned. Proper maintenance is the most effective method of preventing blue smoke emissions from all types of IC engines. The primary constituent of black smoke is agglomerated carbon particles (soot) formed in regions of the combustion mixtures that are oxygen deficient.[2]

3.3.3.5 Sulfur Oxides -

Sulfur oxides emissions are a function of only the sulfur content in the fuel rather than any combustion variables. In fact, during the combustion process, essentially all the sulfur in the fuel is oxidized to SO_2. The oxidation of SO_2 gives sulfur trioxide (SO_3), which reacts with water to give sulfuric acid (H_2SO_4), a contributor to acid precipitation. Sulfuric acid reacts with basic substances to give sulfates, which are fine particulates that contribute to PM-10 and visibility reduction. Sulfur oxide emissions also contribute to corrosion of the engine parts.[2-3]

3.3.4 Control Technologies

Control measures to date are primarily directed at limiting NO_x and CO emissions since they are the primary pollutants from these engines. From a NO_x control viewpoint, the most important distinction between different engine models and types of reciprocating engines is whether they are rich-burn or lean-burn. Rich-burn engines have an air-to-fuel ratio operating range that is near stoichiometric or fuel-rich of stoichiometric and as a result the exhaust gas has little or no excess oxygen. A lean-burn engine has an air-to-fuel operating range that is fuel-lean of stoichiometric; therefore, the exhaust from these engines is characterized by medium to high levels of O_2. The most common NO_x control technique for diesel and dual-fuel engines focuses on modifying the combustion process. However, selective catalytic reduction (SCR) and nonselective catalytic reduction (NSCR) which are post-combustion techniques are becoming available. Controls for CO have been partly adapted from mobile sources.[4]

Combustion modifications include injection timing retard (ITR), preignition chamber combustion (PCC), air-to-fuel ratio adjustments, and derating. Injection of fuel into the cylinder of a CI engine initiates the combustion process. Retarding the timing of the diesel fuel injection causes the combustion process to occur later in the power stroke when the piston is in the downward motion and combustion chamber volume is increasing. By increasing the volume, the combustion temperature and pressure are lowered, thereby lowering NO_x formation. ITR reduces NO_x from all diesel engines; however, the effectiveness is specific to each engine model. The amount of NO_x reduction with ITR diminishes with increasing levels of retard.[4]

Improved swirl patterns promote thorough air and fuel mixing and may include a precombustion chamber (PCC). A PCC is an antechamber that ignites a fuel-rich mixture that propagates to the main combustion chamber. The high exit velocity from the PCC results in improved mixing and complete combustion of the lean air/fuel mixture which lowers combustion temperature, thereby reducing NO_x emissions.[4]

The air-to-fuel ratio for each cylinder can be adjusted by controlling the amount of fuel that enters each cylinder. At air-to-fuel ratios less than stoichiometric (fuel-rich), combustion occurs under conditions of insufficient oxygen which causes NO_x to decrease because of lower oxygen and lower temperatures. Derating involves restricting the engine operation to lower than normal levels of power production for the given application. Derating reduces cylinder pressures and temperatures, thereby lowering NO_x formation rates.[4]

SCR is an add-on NO_x control placed in the exhaust stream following the engine and involves injecting ammonia (NH_3) into the flue gas. The NH_3 reacts with NO_x in the presence of a catalyst to form water and nitrogen. The effectiveness of SCR depends on fuel quality and engine duty cycle (load fluctuations). Contaminants in the fuel may poison or mask the catalyst surface causing a reduction or termination in catalyst activity. Load fluctuations can cause variations in exhaust temperature and NO_x concentration which can create problems with the effectiveness of the SCR system.[4]

NSCR is often referred to as a three-way conversion catalyst system because the catalyst reactor simultaneously reduces NO_x, CO, and HC and involves placing a catalyst in the exhaust stream of the engine. The reaction requires that the O_2 levels be kept low and that the engine be operated at fuel-rich air-to-fuel ratios.[4]

The most accurate method for calculating such emissions is on the basis of "brake-specific" emission factors (pounds per horsepower-hour [lb/hp-hr]). Emissions are the product of the brake-specific emission factor, the usage in hours, the rated power available, and the load factor (the power actually used divided by the power available). However, for emission inventory purposes, it is often easier to assess this activity on the basis of fuel used.

Once reasonable usage and duty cycles for this category were ascertained, emission values were aggregated to arrive at the factors for criteria and organic pollutants presented. Factors in Table 3.3-1 are in pounds per million British thermal unit (lb/MMBtu). Emission data for a specific design type were weighted according to estimated material share for industrial engines. The emission factors in these tables, because of their aggregate nature, are most appropriately applied to a population of industrial engines rather than to an individual power plant. Table 3.3-2 shows unweighted speciated organic compound and air toxic emission factors based upon only 2 engines. Their inclusion in this section is intended for rough order-of-magnitude estimates only.

Table 3.3-3 summarizes whether the various diesel emission reduction technologies (some of which may be applicable to gasoline engines) will generally increase or decrease the selected parameter. These technologies are categorized into fuel modifications, engine modifications, and exhaust after-treatments. Current data are insufficient to quantify the results of the modifications. Table 3.3-3 provides general information on the trends of changes on selected parameters.

3.3.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the CHIEF electronic bulletin board (919-541-5742), or on the new EFIG home page (http://www.epa.gov/oar/oaqps/efig/).

Supplement A, February 1996

No changes.

Supplement B, October 1996

- Text was revised concerning emissions and controls.
- The CO_2 emission factor was adjusted to reflect 98.5 percent conversion efficiency.

Table 3.3-1. EMISSION FACTORS FOR UNCONTROLLED GASOLINE AND DIESEL INDUSTRIAL ENGINES[a]

Pollutant	Gasoline Fuel (SCC 2-02-003-01, 2-03-003-01)		Diesel Fuel (SCC 2-02-001-02, 2-03-001-01)		EMISSION FACTOR RATING
	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	Emission Factor (lb/hp-hr) (power output)	Emission Factor (lb/MMBtu) (fuel input)	
NO_x	0.011	1.63	0.031	4.41	D
CO	0.439	62.7	6.68 E-03	0.95	D
SO_x	5.91 E-04	0.084	2.05 E-03	0.29	D
PM-10[b]	7.21 E-04	0.10	2.20 E-03	0.31	D
CO_2[c]	1.08	154	1.15	164	B
Aldehydes	4.85 E-04	0.07	4.63 E-04	0.07	D
TOC					
Exhaust	0.015	2.10	2.47 E-03	0.35	D
Evaporative	6.61 E-04	0.09	0.00	0.00	E
Crankcase	4.85 E-03	0.69	4.41 E-05	0.01	E
Refueling	1.08 E-03	0.15	0.00	0.00	E

[a] References 2,5-6,9-14. When necessary, an average brake-specific fuel consumption (BSFC) of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hp-hr. To convert from lb/hp-hr to kg/kw-hr, multiply by 0.608. To convert from lb/MMBtu to ng/J, multiply by 430. SCC = Source Classification Code. TOC = total organic compounds.

[b] PM-10 = particulate matter less than or equal to 10 µm aerodynamic diameter. All particulate is assumed to be ≤ 1 µm in size.

[c] Assumes 99% conversion of carbon in fuel to CO_2 with 87 weight % carbon in diesel, 86 weight % carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

Table 3.3-2. SPECIATED ORGANIC COMPOUND EMISSION FACTORS FOR UNCONTROLLED DIESEL ENGINES[a]

EMISSION FACTOR RATING: E

Pollutant	Emission Factor (Fuel Input) (lb/MMBtu)
Benzene[b]	9.33 E-04
Toluene[b]	4.09 E-04
Xylenes[b]	2.85 E-04
Propylene[b]	2.58 E-03
1,3-Butadiene[b,c]	<3.91 E-05
Formaldehyde[b]	1.18 E-03
Acetaldehyde[b]	7.67 E-04
Acrolein[b]	<9.25 E-05
Polycyclic aromatic hydrocarbons (PAH)	
Naphthalene[b]	8.48 E-05
Acenaphthylene	<5.06 E-06
Acenaphthene	<1.42 E-06
Fluorene	2.92 E-05
Phenanthrene	2.94 E-05
Anthracene	1.87 E-06
Fluoranthene	7.61 E-06
Pyrene	4.78 E-06
Benzo(a)anthracene	1.68 E-06
Chrysene	3.53 E-07
Benzo(b)fluoranthene	<9.91 E-08
Benzo(k)fluoranthene	<1.55 E-07
Benzo(a)pyrene	<1.88 E-07
Indeno(1,2,3-cd)pyrene	<3.75 E-07
Dibenz(a,h)anthracene	<5.83 E-07
Benzo(g,h,l)perylene	<4.89 E-07
TOTAL PAH	1.68 E-04

[a] Based on the uncontrolled levels of 2 diesel engines from References 6-7. Source Classification Codes 2-02-001-02, 2-03-001-01. To convert from lb/MMBtu to ng/J, multiply by 430.
[b] Hazardous air pollutant listed in the *Clean Air Act.*
[c] Based on data from 1 engine.

Table 3.3-3. EFFECT OF VARIOUS EMISSION CONTROL TECHNOLOGIES ON DIESEL ENGINES[a]

Technology	Affected Parameter: Increase	Affected Parameter: Decrease
Fuel modifications		
Sulfur content increase	PM, wear	
Aromatic content increase	PM, NO_x	
Cetane number		PM, NO_x
10% and 90% boiling point		PM
Fuel additives		PM, NO_x
Water/Fuel emulsions		NO_x
Engine modifications		
Injection timing retard	PM, BSFC	NO_x, power
Fuel injection pressure	PM, NO_x	
Injection rate control		NO_x, PM
Rapid spill nozzles		PM
Electronic timing & metering		NO_x, PM
Injector nozzle geometry		PM
Combustion chamber modifications		NO_x, PM
Turbocharging	PM, power	NO_x
Charge cooling		NO_x
Exhaust gas recirculation	PM, power, wear	NO_x
Oil consumption control		PM, wear
Exhaust after-treatment		
Particulate traps		PM
Selective catalytic reduction		NO_x
Oxidation catalysts		TOC, CO, PM

[a] Reference 8. PM = particulate matter. BSFC = brake-specific fuel consumption.

References For Section 3.3

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13. *Inventory Of U. S. Greenhouse Gas Emissions And Sinks: 1990-1991*, EPA-230-R-96-006, U. S. Environmental Protection Agency, Washington, DC, November 1995.

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11.12 Concrete Batching

11.12.1 Process Description[1-4]

Concrete is composed essentially of water, cement, sand (fine aggregate), and coarse aggregate. Coarse aggregate may consist of gravel, crushed stone, or iron blast furnace slag. Some specialty aggregate products could be either heavyweight aggregate (of barite, magnetite, limonite, ilmenite, iron, or steel) or lightweight aggregate (with sintered clay, shale, slate, diatomaceous shale, perlite, vermiculite, slag, pumice, cinders, or sintered fly ash). Concrete batching plants store, convey, measure, and discharge these constituents into trucks for transport to a job site. In some cases, concrete is prepared at a building construction site or for the manufacture of concrete products such as pipes and prefabricated construction parts. Figure 11.12-1 is a generalized process diagram for concrete batching.

The raw materials can be delivered to a plant by rail, truck, or barge. The cement is transferred to elevated storage silos pneumatically or by bucket elevator. The sand and coarse aggregate are transferred to elevated bins by front end loader, clam shell crane, belt conveyor, or bucket elevator. From these elevated bins, the constituents are fed by gravity or screw conveyor to weigh hoppers, which combine the proper amounts of each material.

Truck mixed (transit mixed) concrete involves approximately 75 percent of U. S. concrete batching plants. At these plants, sand, aggregate, cement, and water are all gravity fed from the weigh hopper into the mixer trucks. The concrete is mixed on the way to the site where the concrete is to be poured. Central mix facilities (including shrink mixed) constitute the other one-fourth of the industry. With these, concrete is mixed and then transferred to either an open bed dump truck or an agitator truck for transport to the job site. Shrink mixed concrete is concrete that is partially mixed at the central mix plant and then completely mixed in a truck mixer on the way to the job site. Dry batching, with concrete mixed and hauled to the construction site in dry form, is seldom, if ever, used.

11.12.2 Emissions And Controls[5-7]

Emission factors for concrete batching are given in Tables 11.12-1 and 11.12-2, with potential air pollutant emission points shown. Particulate matter, consisting primarily of cement dust but including some aggregate and sand dust emissions, is the only pollutant of concern. All but one of the emission points are fugitive in nature. The only point source is the transfer of cement to the silo, and this is usually vented to a fabric filter or "sock". Fugitive sources include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. The amount of fugitive emissions generated during the transfer of sand and aggregate depends primarily on the surface moisture content of these materials. The extent of fugitive emission control varies widely from plant to plant.

Types of controls used may include water sprays, enclosures, hoods, curtains, shrouds, movable and telescoping chutes, and the like. A major source of potential emissions, the movement of heavy trucks over unpaved or dusty surfaces in and around the plant, can be controlled by good maintenance and wetting of the road surface.

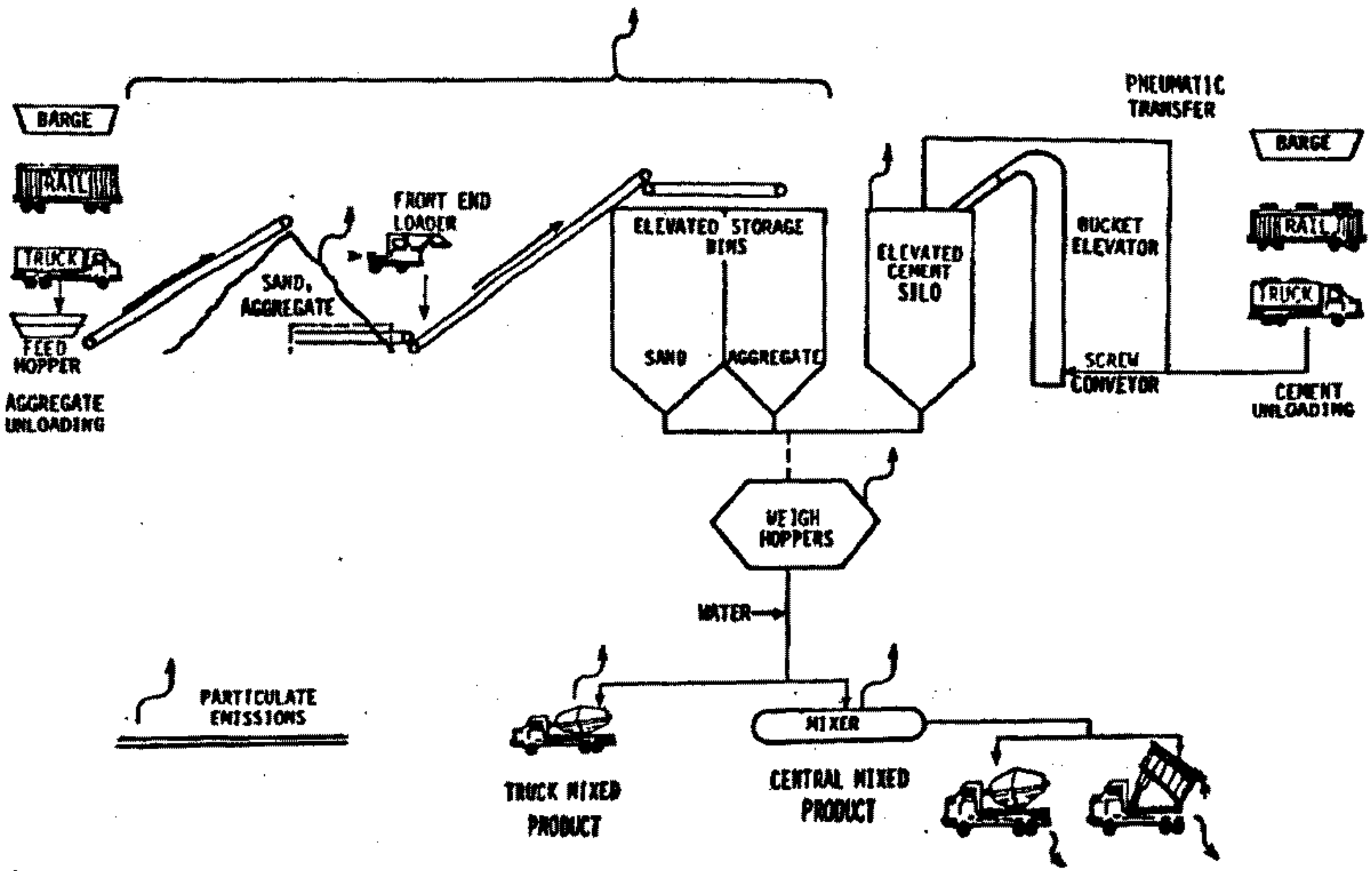

Figure 11.12-1. Typical concrete batching process.

Table 11.12-1 (Metric Units). EMISSION FACTORS FOR CONCRETE BATCHING[a]

Source (SCC)	Filterable[b] PM	RATING	PM-10	Condensable PM[c] Inorganic	Organic
Sand and aggregate transfer to elevated bin (3-05-011-06)[d]	0.014	E	ND	ND	ND
Cement unloading to elevated storage silo					
Pneumatic[e]	0.13	D	ND	ND	ND
Bucket elevator (3-05-011-07)[f]	0.12	E	ND	ND	ND
Weigh hopper loading (3-05-011-8)[g]	0.01	E	ND	ND	ND
Mixer loading (central mix) (3-05-011-09)[g]	0.02	E	ND	ND	ND
Truck loading (truck mix) (3-05-011-10)[g]	0.01	E	ND	ND	ND
Vehicle traffic (unpaved roads) (3-05-011-__)[h]	4.5	C	ND	ND	ND
Wind erosion from sand and aggregate storage piles (3-05-011__)[i]	3.9	D	ND	ND	ND
Total process emissions (truck mix)(3-05-011-_)[j]	0.05	E	ND	ND	ND

[a] Factors represent uncontrolled emissions unless otherwise noted. All emission factors are in kg/Mg of material mixed unless noted. Based on a typical yd^3 weighing 1.818 kg (4,000 lb) and containing 227 kg (500 lb) cement, 564 kg (1,240 lb) sand, 864 kg (1,900 lb) coarse aggregate, and 164 kg (360 lb) water. SCC = Source Classification Code. ND = no data.

[b] Filterable PM is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train.

[c] Condensable PM is that PM collected in the impinger portion of a PM sampling train.

[d] Reference 6.

[e] For uncontrolled emissions measured before filter. Based on 2 tests on pneumatic conveying controlled by a fabric filter.

[f] Reference 7. From test of mechanical unloading to hopper and subsequent transport of cement by enclosed bucket elevator to elevated bins with fabric socks over bin vent.

[g] Reference 5. Engineering judgment, based on observations and emissions tests of similar controlled sources.

[h] From Section 13.2-1, with k = 0.8, s = 12, S = 20, W = 20, w = 14, and p = 100; units of kg/vehicle kilometers traveled; based on facility producing 23,100 m^3/yr (30,000 yd^3/yr) of concrete, with average truck load of 6.2 m^3 (8 yd^3) and plant road length of 161 meters (0.1 mile).

[i] From Section 11.19-1, for emissions <30 micrometers from inactive storage piles; units of kg/hectare/day.

[j] Based on pneumatic conveying of cement at a truck mix facility. Does not include vehicle traffic or wind erosion from storage piles.

Table 11.12-2 (English Units). EMISSION FACTORS FOR CONCRETE BATCHING[a,b]

Source (SCC)	Filterable[c] PM	RATING	PM-10	Condensable PM[d] Inorganic	Organic
Sand and aggregate transfer to elevated bin (3-05-011-06)[e]	0.029 (0.05)	E	ND	ND	ND
Cement unloading to elevated storage silo					
Pneumatic[f]	0.27 (0.07)	D	ND	ND	ND
Bucket elevator (3-05-011-07)[g]	0.24 (0.06)	E	ND	ND	ND
Weigh hopper loading (3-05-011-08)[h]	0.02 (0.04)	E	ND	ND	ND
Mixer loading (central mix) (3-05-011-09)[h]	0.04 (0.07)	E	ND	ND	ND
Truck loading (truck mix) (3-05-011-10)[h]	0.02 (0.04)	E	ND	ND	ND
Vehicle traffic (unpaved roads) (3-05-011-__)[i]	16 (0.02)	C	ND	ND	ND
Wind erosion from sand and aggregate storage piles (3-05-011-__)[j]	3.5[k] (0.1)[l]	D	ND	ND	ND
Total process emissions (truck mix) (3-05-011-__)[m]	0.1 (0.2)	E	ND	ND	ND

[a] Factors represent uncontrolled emissions unless otherwise noted. All emission factors are in lb/ton (~~lb/yd³~~) OK of material mixed unless noted. SCC = Source Classification Code. ND = no data.

[b] Based on a typical yd³ weighing 1,818 kg (4,000 lb) and containing 227 kg (500 lb) cement, 564 kg (1,240 lb) sand, 864 kg (1,900 lb) coarse aggregate, and 164 kg (360 lb) water.

[c] Filterable PM is that PM collected on or prior to the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Condensable PM is that PM collected in the impinger portion of a PM sampling train.

[e] Reference 6.

[f] For uncontrolled emissions measured before filter. Based on 2 tests on pneumatic conveying controlled by a fabric filter.

[g] Reference 7. From test of mechanical unloading to hopper and subsequent transport of cement by enclosed bucket elevator to elevated bins with fabric socks over bin vent.

[h] Reference 5. Engineering judgment, based on observations and emission tests of similar controlled sources.

[i] From Section 13.2.1, with k = 0.8, s = 12, S = 20, W = 20, w = 14, and p = 100; units of lb/vehicle miles traveled; based on facility producing 23,100 m³/yr (30,000 yd³/yr) of concrete, with average truck load of 6.2 m³ (8 yd³) and plant road length of 161 meters (0.1 mile).

[j] From Section 11.19.1, for emissions <30 micrometers from inactive storage piles.

[k] Units of lb/acre/day.

[l] Assumes 1,011 m² (1/4 acre) of sand and aggregate storage at plant with production of 23,000 m³/yr (30,000 yd³/yr).

[m] Based on pneumatic conveying of cement at a truck mix facility; does not include vehicle traffic or wind erosion from storage piles.

Predictive equations that allow for emission factor adjustment based on plant-specific conditions are given in Chapter 13. Whenever plant specific data are available, they should be used in lieu of the fugitive emission factors presented in Table 11.12-1.

References For Section 11.12

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 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

 Challis Redi-Mix    Generators

 SIMPLE TERRAIN INPUTS:
    SOURCE TYPE              =        POINT
    EMISSION RATE (G/S)      =     0.126000
    STACK HEIGHT (M)         =       0.9144
    STK INSIDE DIAM (M)      =       0.1015
    STK EXIT VELOCITY (M/S)  =      58.3338
    STK GAS EXIT TEMP (K)    =     749.8167
    AMBIENT AIR TEMP (K)     =     293.1500
    RECEPTOR HEIGHT (M)      =       0.0000
    URBAN/RURAL OPTION       =        RURAL
    BUILDING HEIGHT (M)      =       0.0000
    MIN HORIZ BLDG DIM (M)   =       0.0000
    MAX HORIZ BLDG DIM (M)   =       0.0000

 THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
 THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


 BUOY. FLUX =    0.897 M**4/S**3;  MOM. FLUX =    3.426 M**4/S**2.

 *** FULL METEOROLOGY ***

 **********************************
 *** SCREEN AUTOMATED DISTANCES ***
```

2400.	13.05	6	1.0	1.0	10000.0	24.71	75.43	24.84	NO
2500.	12.57	6	1.0	1.0	10000.0	24.71	78.24	25.35	NO
2600.	12.12	6	1.0	1.0	10000.0	24.71	81.05	25.86	NO
2700.	11.70	6	1.0	1.0	10000.0	24.71	83.85	26.36	NO
2800.	11.29	6	1.0	1.0	10000.0	24.71	86.63	26.86	NO
2900.	10.91	6	1.0	1.0	10000.0	24.71	89.41	27.34	NO
3000.	10.54	6	1.0	1.0	10000.0	24.71	92.17	27.82	NO
3500.	9.018	6	1.0	1.0	10000.0	24.71	105.87	29.77	NO
4000.	7.835	6	1.0	1.0	10000.0	24.71	119.36	31.58	NO
4500.	6.896	6	1.0	1.0	10000.0	24.71	132.68	33.27	NO
5000.	6.136	6	1.0	1.0	10000.0	24.71	145.83	34.88	NO
5500.	5.510	6	1.0	1.0	10000.0	24.71	158.84	36.40	NO
6000.	4.987	6	1.0	1.0	10000.0	24.71	171.71	37.85	NO
6500.	4.545	6	1.0	1.0	10000.0	24.71	184.47	39.24	NO
7000.	4.166	6	1.0	1.0	10000.0	24.71	197.11	40.57	NO
7500.	3.848	6	1.0	1.0	10000.0	24.71	209.65	41.72	NO
8000.	3.570	6	1.0	1.0	10000.0	24.71	222.09	42.82	NO
8500.	3.327	6	1.0	1.0	10000.0	24.71	234.44	43.89	NO
9000.	3.111	6	1.0	1.0	10000.0	24.71	246.70	44.92	NO
9500.	2.919	6	1.0	1.0	10000.0	24.71	258.88	45.91	NO
10000.	2.748	6	1.0	1.0	10000.0	24.71	270.99	46.88	NO
15000.	1.689	6	1.0	1.0	10000.0	24.71	388.49	55.30	NO
20000.	1.214	6	1.0	1.0	10000.0	24.71	500.99	60.68	NO
25000.	0.9387	6	1.0	1.0	10000.0	24.71	609.79	65.21	NO
30000.	0.7602	6	1.0	1.0	10000.0	24.71	715.62	69.17	NO
40000.	0.5517	6	1.0	1.0	10000.0	24.71	920.25	74.80	NO
50000.	0.4303	6	1.0	1.0	10000.0	24.71	1117.44	79.48	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

23.	253.8	4	20.0	20.0	6400.0	1.90	2.18	1.36	NO

125 kW

$4.41 \frac{\# NO_x}{MMBtu} \quad \frac{0.137\ MMBtu}{gal} \quad \frac{9\ gal}{hr} = 5.4 \frac{\# NO_x}{hr}$

$0.95 \frac{\# CO}{MMBtu}$ " " $= 1.2 \frac{\# CO}{hr}$

$0.29 \frac{\# SO_x}{MMBtu}$ " " $= 0.36 \frac{\# SO_x}{hr}$

$0.31 \frac{\# PM_{10}}{MMBtu}$ " " $= 0.38 \frac{\# PM_{10}}{hr}$

10 hp

$0.031 \frac{\# NO_x}{hp\ hr} \cdot 10\ hp = 0.31 \frac{\# NO_x}{hr}$

$0.00668 \frac{\# CO}{hp\ hr} \cdot 10\ hp = 0.0668 \frac{\# CO}{hr}$

$0.00205 \frac{\# SO_x}{hp\ hr} \cdot 10\ hp = 0.0205 \frac{\# SO_x}{hr}$

$0.0022 \frac{\# PM_{10}}{hp\ hr} \cdot 10\ hp = 0.022 \frac{\# PM_{10}}{hr}$

Assume common stack (conservative)

Total

$5.71\ \# NO_x / hr$

$1.2668\ \# CO / hr$

$0.3805\ \# SO_x / hr$

$0.402\ \# PM_{10} / hr$

Background

	All values in (µg/m^3)					
Criteria Pollutants	1-hr	3-hr	8-hr	24-hr	Quarterly	Annual
PM_{10}***				86		32.7
SO_x****		374		120		18.3
NO_x*****						40
CO******	11,450		5,130			
Lead					0.17	

NAAQS**

	All values in (µg/m^3)					
Criteria Pollutants	1-hr	3-hr	8-hr	24-hr	Quarterly	Annual
PM_{10}				150		50
SO_x		1,300		365		80
NO_x						100
CO	40,000		10,000			
Lead					1.5	

Compare Ambient Concentrations to NAAQS minus Background (i.e. Limit), using AP-42

Criteria		All values in (µg/m^3)												Meets
Pollutants	lb/hr	1-hr	Limit	3-hr	Limit	8-hr	Limit	24-hr	Limit	Quarterly	Limit	Annual*	Limit	NAAQS?
PM_{10}	0.4	1.02E+02						4.06E+01	64			4.18E+00	17.3	YES
SO_x	0.36	9.65E+01		8.69E+01	926			3.86E+01	245			3.97E+00	61.7	YES
NO_x	5.71	1.45E+03										5.96E+01	60	YES
CO	1.27	3.23E+02	28,550			2.26E+02	4,870							YES

Concentrations from SCREEN3 model, AP-42 Table 3.3-1, and a maximum fuel input of 9 gal/hr obtained from the facility by phone.

SCREEN3 one hour concentration in micrograms per cubic meter 254

*Assumes operation for less than 4,500 hours per year as will be required in the permit. The facility could be allowed more than 4,500 hours per year and the NAAQS would still be protected. However, the facility has stated that they would not approach 4,500 hours per year. The limit was imposed to prevent unrealistically high potential emissions for the facility.

**National Ambient Air Quality Standards

***Particles with an aerodynamic diameter less than or equal to a nominal ten (10) micrometers

****Oxides of Sulfur

*****Oxides of Nitrogen

******Carbon Monoxide

SICO EMISSIONS

$$\frac{0.07 \text{ lb PM}}{\text{yd}^3 \text{ concrete}} \left| \frac{\text{yd}^3 \text{ concrete}}{4000 \text{ lb concrete}} \right| \frac{4000 \text{ lb concrete}}{500 \text{ lb cement}}$$

$$\frac{0.00014 \text{ lb PM}}{\text{lb cement}}$$

Note: all numbers are from AP 42

typical 70,000 lb delivery

delivery 500 - 700 lb/min

use 700 lb/min

$$\frac{0.00014 \text{ lb PM}}{\text{lb cement}} \left| \frac{700 \text{ lb cement}}{\text{min}} \right| \frac{60 \text{ min}}{\text{hr}}$$

0% control efficiency ⇒ 5.88 lb PM/hr

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```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

challis cement silo

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE              =       POINT
   EMISSION RATE (G/S)      =    0.740900
   STACK HEIGHT (M)         =     12.8016
   STK INSIDE DIAM (M)      =      0.1016
   STK EXIT VELOCITY (M/S)  =      0.0000
   STK GAS EXIT TEMP (K)    =    293.1500
   AMBIENT AIR TEMP (K)     =    293.1500
   RECEPTOR HEIGHT (M)      =      0.0000
   URBAN/RURAL OPTION       =       RURAL
   BUILDING HEIGHT (M)      =      4.2672
   MIN HORIZ BLDG DIM (M)   =      9.1440
   MAX HORIZ BLDG DIM (M)   =     15.2400

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.


BUOY. FLUX =    0.000 M**4/S**3;  MOM. FLUX =    0.000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
```

2400.	100.1	6	1.0	1.1	10000.0	12.50	75.12	23.89	NO
2500.	94.87	6	1.0	1.1	10000.0	12.50	77.95	24.42	NO
2600.	90.12	6	1.0	1.1	10000.0	12.50	80.76	24.95	NO
2700.	85.75	6	1.0	1.1	10000.0	12.50	83.57	25.47	NO
2800.	81.73	6	1.0	1.1	10000.0	12.50	86.36	25.98	NO
2900.	78.02	6	1.0	1.1	10000.0	12.50	89.15	26.48	NO
3000.	74.58	6	1.0	1.1	10000.0	12.50	91.92	26.98	NO
3500.	61.27	6	1.0	1.1	10000.0	12.50	105.65	28.98	NO
4000.	51.61	6	1.0	1.1	10000.0	12.50	119.17	30.84	NO
4500.	44.32	6	1.0	1.1	10000.0	12.50	132.50	32.57	NO
5000.	38.65	6	1.0	1.1	10000.0	12.50	145.67	34.21	NO
5500.	34.13	6	1.0	1.1	10000.0	12.50	158.69	35.76	NO
6000.	30.46	6	1.0	1.1	10000.0	12.50	171.58	37.23	NO
6500.	27.43	6	1.0	1.1	10000.0	12.50	184.34	38.64	NO
7000.	24.88	6	1.0	1.1	10000.0	12.50	196.99	40.00	NO
7500.	22.79	6	1.0	1.1	10000.0	12.50	209.54	41.16	NO
8000.	21.00	6	1.0	1.1	10000.0	12.50	221.98	42.28	NO
8500.	19.44	6	1.0	1.1	10000.0	12.50	234.34	43.36	NO
9000.	18.07	6	1.0	1.1	10000.0	12.50	246.61	44.40	NO
9500.	16.87	6	1.0	1.1	10000.0	12.50	258.79	45.41	NO
10000.	15.80	6	1.0	1.1	10000.0	12.50	270.90	46.38	NO
15000.	9.410	6	1.0	1.1	10000.0	12.50	388.43	54.88	NO
20000.	6.671	6	1.0	1.1	10000.0	12.50	500.95	60.29	NO
25000.	5.110	6	1.0	1.1	10000.0	12.50	609.75	64.86	NO
30000.	4.111	6	1.0	1.1	10000.0	12.50	715.59	68.84	NO
40000.	2.962	6	1.0	1.1	10000.0	12.50	920.22	74.49	NO
50000.	2.298	6	1.0	1.1	10000.0	12.50	1117.42	79.19	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

120.	646.2	3	1.0	1.0	320.0	12.50	14.86	8.86	NO

CONC (UG/M**3) = 0.000
DIST TO MAX (M) = 100.00

DIST TO MAX IS < 2000. M. CONC SET = 0.0

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	646.2	120.	0.

PREDICTED SILO IMPACT

UNCONTROLLED

646 $\frac{\mu g}{m^3}$ 1-HR AVE SCREEN3

$\times$ 0.4 24-HR PERSISTENCE

258 $\frac{\mu g}{m^3}$ 24-HR AVE

ALLOW = NAAQS - BKGRND - GENERATORS

= 150 - 86 - 41 = 23 $\frac{\mu g}{m^3}$

RESTRICT HOURS ~~& FLOW RATE~~

ALLOW MAX FLOWRATE = 700 $\frac{lb}{min}$

$$\frac{\text{ALLOW HRS}}{24 \text{ HRS}} = \frac{23}{258}$$

$\therefore$ ALLOW $\leq$ 2 HRS (120 min)
@ 700 lb/min

NOTE: THIS ALLOWS ONE TYPICAL DELIVERY PER DAY

120 $\times$ 700 = 84 000 lb

(TYP DELIVERY = 70 000 lb)

NOTE: 24-HR COMPLIANCE $\Rightarrow$ ANNUAL COMPLIA

EG: $150 \frac{\mu g}{m^3} \left(\frac{0.08}{0.4}\right) = 30 \frac{\mu g}{m^3} < 50 \frac{\mu g}{m^3}$

Modeled Conc. @ 1 lb/hr emission rate (µg/m³) =	254
*Heat Input (kW) =	133
Heat Value (Btu/gal) =	140,000
Hours of Operation (hr/yr) =	500
Heat Input (MM Btu/hr) =	0.45
Heat Input (MM Btu/yr) =	227
Gallons of Fuel Burned (gal/hr) =	3
Gallons of Fuel Burned (Mgal/yr) =	1.62

*125 kW + 10 hp (7.5 kW) = 133 kW

Pollutant	EF uncontrolled diesel engines (lb/MMBtu)	
Acrolein	9.25E-05	
Benzene	9.33E-04	
Benzo(a)pyrene	1.88E-07	PAH
Benzo(b)fluoranthene	9.91E-08	PAH
Benzo(k)fluoranthene	1.55E-07	PAH
Chrysene	3.53E-07	PAH
Dibenzo(a,h)anthracene	5.83E-07	PAH
Formaldehyde	1.18E-03	
Indeno(1,2,3-cd)pyrene	3.75E-07	PAH
Naphthalene	8.48E-05	
Toluene	4.09E-04	
Xylenes	2.85E-04	
PAH	1.75E-06	

Non-carcinogenic (IDAPA 58.01.01.585)

Pollutant	ER (lb/hr)	EL (lb/hr)	Modeling Required?	*24-hr (mg/m3)	AAC (mg/m3)	24-hr < AAC?	OK?
Acrolein	4.20E-05	1.70E-02	N	4.26E-06	1.25E-02	Y	Y
Naphthalene	3.85E-05	3.33E+00	N	3.91E-06	2.50E+00	Y	Y
Toluene	1.86E-04	2.50E+01	N	1.89E-05	1.88E+01	Y	Y
Xylenes	1.29E-04	2.90E+01	N	1.31E-05	2.18E+01	Y	Y
*24-hr persistance factor =		0.4					

Carcinogenic (IDAPA 58.01.01.586)

Pollutant	Generator (lb/hr	EL (lb/hr)	Modeling Required?	**Annual (µg/m3)	AACC (µg/m3)	Annual < AACC?	OK?
Benzene	4.23E-04	8.00E-04	N	1.34E-02	1.20E-01	Y	Y
PAH	7.96E-07	2.00E-06	N	2.53E-05	3.00E-04	Y	Y
Formaldehyde	5.35E-04	5.10E-04	Y	1.70E-02	7.70E-02	Y	Y
**Annual persistance factor =		0.125					

Cement Silo	ER (lb/hr)	EL (lb/hr)	Modeling Required?	*24-hr (mg/m3)	AAC (mg/m3)	24-hr < AAC?	OK?
Portland Ceme	5.88	0.667	Y	0.13	0.5	Y	Y
			*24-hr persistance factor =	0.4			
			Modeled Conc. @ 1 lb/hr emission rate (µg/m³) =	646			

Note: The 24-hr concentration was reduced by the ratio of permitted daily emissions to maximum daily emissions = 84,000/1,008,000 = 0.083
700 pounds per minute (maximum), 60 minutes per hour, 24 hours per day => 1,008,000 pounds per day .

Appendix B

AIRS Database Update Form

ABBREVIATED AIRS DATA ENTRY SHEET - CONCRETE BATCH PLANT

Name of Facility: Challis Redi-Mix

AIRS/Permit #: 037-00008

Permit Issue Date: September 21, 2001

Source/Emissions Unit Name (25 spaces) (Please use name as indicated in permit)	SCC # (8 digit #)	Air Program (SIP/NESHAP/ NSPS/PSD/MACT)
Flyash/Cement to Silo	30501199	SIP
Diesel Generator	20200401	SIP
Aggregate Handling/Piles	30500204	SIP
Transit Mix Truck Loading	30501110	SIP
Fugitives	30588801	SIP
Property Boundary	30588801	SIP

RETURN TO PAT RAYNE
AIRS-PT.LST (9/95)

September 17, 2001

State of Idaho, Department of Environmental Quality

Responses to Comments and Questions Submitted during a Public Comment Period for Challis Redi-Mix's Proposed Tier II Operating Permit

Introduction

The public comment period for Challis Redi-Mix's proposed Tier II operating permit was held from August 9, 2001 through September 10, 2001, as required by IDAPA 58.01.01.404.01.c (*Rules for the Control of Air Pollution in Idaho*). A public hearing was not requested by the facility and the Director did not determine that there was good cause to hold a hearing in accordance with IDAPA 58.01.01.404.02.c. Comment packages that included the permit application, Idaho Department of Environmental Quality (DEQ) technical analysis, and the proposed permit were made available at DEQ's State Office in Boise, DEQ's Regional Office in Idaho Falls, and the Challis Public Library. Comments were received by DEQ through postal mail and electronic mail.

Public comments regarding the air quality aspects of the proposed permit and analysis have been summarized below. Due to the similarity of many of the comments received, the summary presented below will have some comments that have been combined and/or paraphrased in order to eliminate duplication and to provide a more concise summary. Questions, comments, and/or suggestions received during the comment period which do not relate to the air quality aspects of the permit application, DEQ's technical analysis, or the proposed permit are not addressed.

Public Comments and DEQ Responses

Comment 1: Several public comments were submitted to DEQ addressing an adverse impact to ambient air quality as a result of the Challis Redi-Mix facility.

Response to 1: In accordance with IDAPA 58.01.01.403, a facility is allowed to operate provided the operation does not cause or contribute to a violation of an ambient air quality standard.

Comment 2: A public comment was submitted to DEQ expressing concern over road dust.

Response to 2: The permit requires the facility to reasonably control fugitive emissions from the facility.

Comment 3: A public comment was submitted to DEQ stating that the facility does not have a sock on the silo and referenced photographs. The photographs appear to show fugitive emissions crossing the property boundary and silo emissions in excess of 20 percent opacity.

Response to 3: The permit does not allow fugitive emissions to cross the boundary and requires reasonable control. The permit requires an air pollution control device to control visible emissions.

End of comments.